PRACTICAL EDUCATIONAL CHALLENGES WITH BUSINESS ANALYTICS

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1. INTRODUCTION

Today's complex world demands skilled, knowledgeable and innovative citizens. But the reality is challenging – rising costs of education, reduction funding, structural silos of schools and universities, little insight [Christensen (2011a), Christensen (2011)]. Yet schools still struggle to educate students with the basics. To find a smarter way, education is turning to technology to overcome these barriers and ensure students are learning what they need to succeed and contribute to themselves and community. New, innovative venture creation is considered to be important strategy for the future achievements of the students. Their performance is critical to the future welfare of the economy and society. It is also vital for the youngsters to gain experience in real work. The practical experience and experiments give them the feeling for real time exposure to business, which allow them to undertake pressure of the environment. To do so, we must recognize the potential of both students and stakeholders. The clear knowledge of the performance of students, teachers and consultants and their effective, early involvement are essential to prevent weaknesses and future failure [LaValle (2010), Taylor (2010)].

All stakeholders want to know the factors connecting student achievement. Why do some students and student companies succeed while others fail? Why some student companies win and continue their work and others don't? Why do we see such remarkable difference in their performance? Managers are ready to respond and make changes, but most of them are unprepared and uncertain where to start. Using the gathered information for students, predictive analytics will help us to recognize the successful patterns for better performance of students and their startup companies. The analysis will lend managers hand and predict proactively to uncover causes and offer encouragement to focus harder.

The goal of the paper is to use Junior Achievement (JA) student companies data bases and IBM SPSS Predictive Analytics tool to describe:

- students profiles
- characteristics of consultants and business volunteers that are likely to support the program.

In the paper we will try to answer to the following challenging questions:

- What types of companies will attract more students?
- What types of companies are more likely to make sales?
- What types of companies are more likely to establish a real business?

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2. METHODOLOGY AND RESEARCH DESIGN

In this paper we apply combination of an explicit data base, sophisticated analytical skills and domain knowledge to uncover hidden trends and patterns in the student's entrepreneurship competitions. We have used IBM SPSS and SPSS Predictive Analytics software to analyze and visualize the history of the student companies [SPSS inc. (2007), IBM Corp. (2010a), IBM Corp. (2010b), Morelli (2010)]. IBM® SPSS® Modeler offers a strategic approach to finding useful relationships in large data sets. The methodology follows CRISP-DM 1.0 reference model [IBM Corp. (2010c)]. The method goes behind processes from capture holistic data view of the customer (*descriptive, behavioral, interaction and attitudinal*), predict through advanced analysis and act to the successful deployment of analytical results to improve educational processes. Analytics helps us to look into the future and recognize what will happen in any current or upcoming case, based on what has happened before.

The models will help us to predict innovative opportunities, activities or procedures and proactively act upon that insight to drive better educational and business outcomes [Haralampiev (2011)].

Overview: Junior Achievement Worldwide is the world's biggest organization dedicated to educating high school and academic students about workforce readiness, entrepreneurship and financial literacy through experiential, hands-on programs (http://www.jaworldwide.org/). JA Bulgaria implements a set of programs for curricula and extracurricular education, focusing more on the practical process [Stoycheva (2008), Ruskov (2011)]. The JA secondary schools and graduate student programs are highly quantitative program that prepares students to become successful entrepreneurs.

Business need: To extend school and university curricula and to make students education more "job ready" by teaching and practicing the entire innovational and entrepreneurship processes, instead of just the theory and class exercises. Our team recognized that it is needed to teach students "the big picture" of venture creation and entrepreneurship. We believe that change in the mindset and values would make students more profitable in the workplace. By expansion of their practical skills, they will meet the entrepreneurial needs of a broad range of industries.

Solution: For the current research our team decided to use IBM SPSS Statistics and IBM SPSS Modeler, because its implementation is easy to learn and model. The software seamlessly integrated with the entire data bases and family of analytics products. This analytics and decision management software helped us to discover patterns, identify critical thresholds and monitor for signs of struggle.

Benefits: Data-driven statistical analysis of student company behavior and company analytics give schools' and universities' decision makers a valuable basis for understanding inside student learning and training processes and making students education more "job ready".

JA has enough databases of students' information that is available for analysis. The first step of our research was to create a complete picture of the stakeholders. Taking in mind the specifics of the different level of education and the characteristics of student companies, the data descriptions was separated in two groups – high schools and universities.

After processing the data we distinguished groups of indicators for high schools and university companies in Bulgaria. Each target group includes sub categories of variables – Table 1. [Haralampiev (2011)]. The identified indicators were selected on basis of empirical experience and the collector intended to have the most comprehensive profile of the program participants, their activities, the factors that are influencing the decision to join the program and the factors for success.

Table 1. Groups of indicators for highs schools and university Student companies

Indicators for highs schools companies	Indicators for university companies
1. ***Schools profile*** – Type of school, according to national classification of Ministry of Education and Science, Place of school – rural area, central city or municipality city etc.	1. ***University profile*** – University name, Location, Postal code, Field of education etc.
2. ***Teachers profile*** – Gender specification, Number of teachers per student company etc.	2. ***University tutors profile*** – Gender, Faculty, Previous program experience etc.
3. ***Business consultants profile*** – Gender.	3. ***Business consultants profile*** – Gender, Occupation/Job position, Type of organization, National Classification of Economic Activities, Previous program experience etc.
4. ***Students profile*** – Gender, Class in school, Overall students in company etc.	4. ***University students profile*** – Year of education, Field of education, Gender, Previous program experience etc.
5. ***Student company profile*** – Specification of the activity of the company, according to National Classification of Economic Activities, Participation in National Competition, Participation in competitions abroad, If the company has won any special prize or place in the top three runners.	5. ***Students company profile*** – Number of participants, Gender, Business activity, according to the National Classification of Economic Activities etc.

3. DISCUSSIONS

The high school and university student educational organizations face community demands for better competences. Analyzing the JA databases, we have identified the factors that are driving Student Company's behavior and can predicted the likelihood of students, teachers and consultants. For the current research we applied the predictive analytics of the statistical tool of IBM SPSS Modeler for testing hypotheses and the modeling for creating models that predict future outcomes.

Figure 1. gives you an idea about JA Student Companies 2011 project and streams.

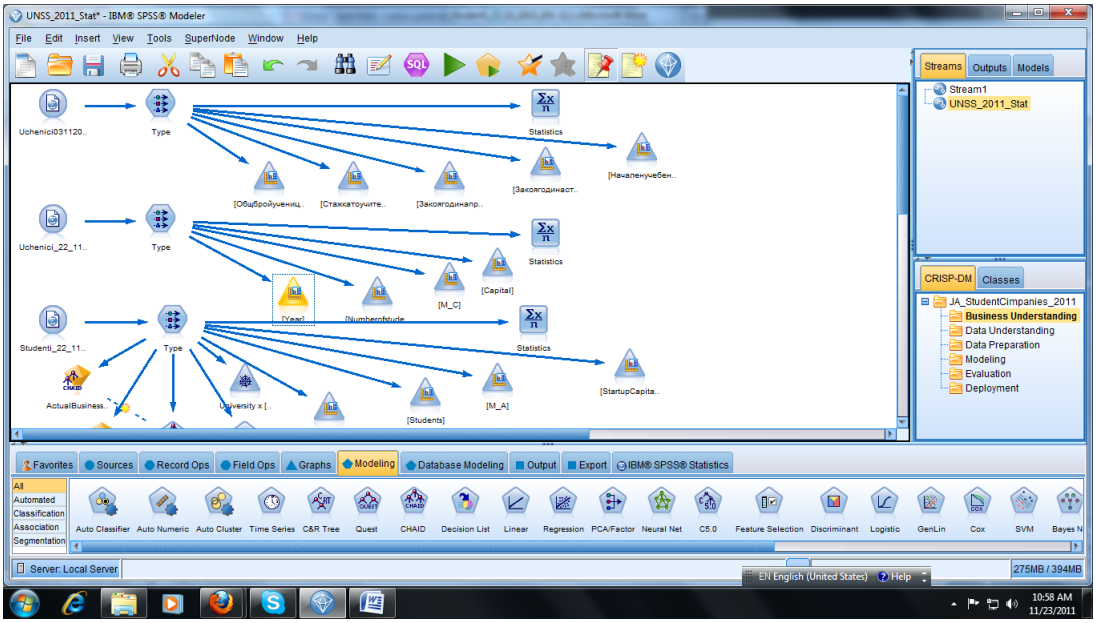
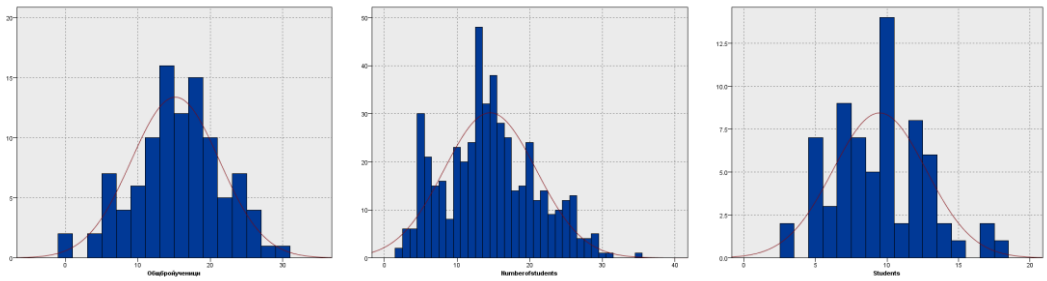


Figure 1. JA Student Companies 2011 project and streams

We have started solving the puzzle of student companies' success and failure by combining and analyzing their own data and discussing questions such as:

- What is the distribution of student companies by number of students? – Figure 2.

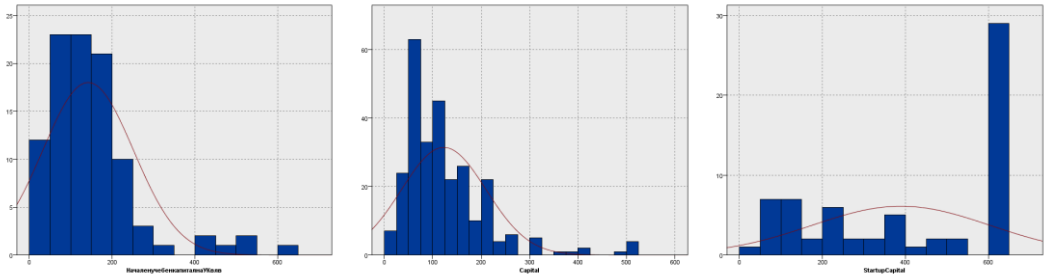


High school companies 2011 (mean 15.2) | High school companies 2006-2010 (mean 14.6) | University companies 2007-2010 (mean 9.5)

Figure 2. Distribution of student companies by number of students

There is almost no difference in shape of distribution between the high school and university companies, the differences are only in the means. In the schools companies the number of students is higher.

- What is the distribution of student companies by startup capital? – Figure 3.

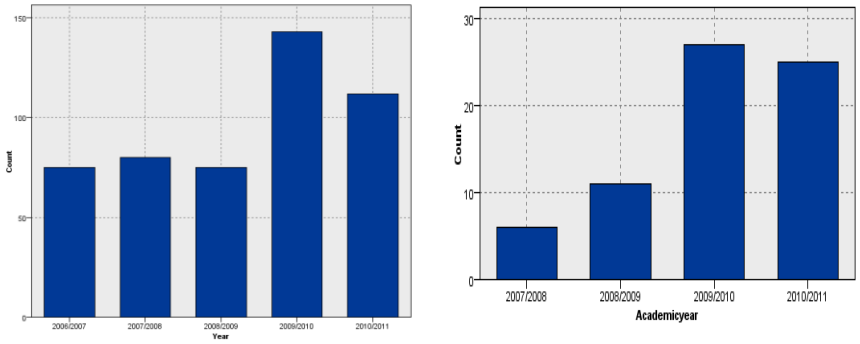


High school companies 2011 (mean 142.14) | High school companies 2006-2010 (mean 122.58) | University companies 2007-2010 (mean 389.27)

Figure 3. Distribution of student companies by startup capital

The distribution by startup capital is significantly different between high school and university companies – for school companies the distribution is right skewed and for the student companies – left skewed, i.e. school student companies are concentrated on small amounts of capital while the university startups – on large.

- What is the distribution of student companies by academic year? – Figure 4.



High school companies 2006-2010 University companies 2007-2010

Figure 4. Distribution of student companies by academic year

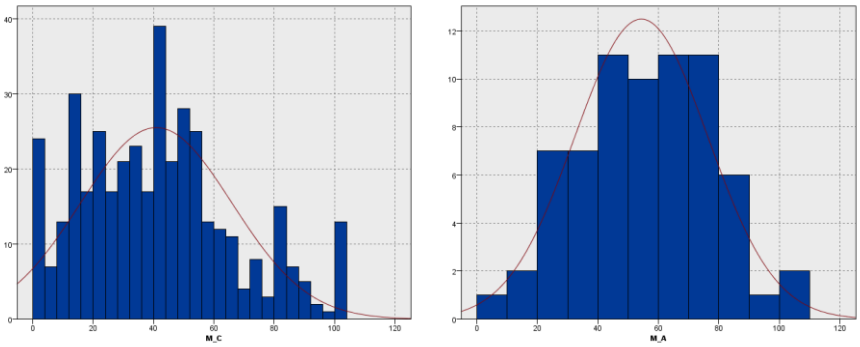
The explanation behind the dynamics of university companies' distribution could be summarized by the following key factors. In the end of 2007, JA Bulgaria began an informational campaign to raise awareness about the university startup program and to recruit participants. Several strategic meetings and discussions were organized in cooperation with university rectors and deans of faculty during the period. In the beginning of 2008, the first official training for tutors/consultants and students was organized. As a result 5 universities joined the program and 6 student companies were created. In the next years a rapid growth in the number of university student companies followed, especially for the academic 2009/10, that could be explained with: 1.) The first two years of operation positioned the program as a successful practice in the entrepreneurial education and an attractive way of learning; 2.) In 2008, JA Bulgaria launched the annual national competition for university

student companies – a business networking event offering added value to the program; 3.) The number of annual program trainings was increased.

In 2010/11 there was a slight decrease in the number of student companies since 3 of the target universities temporarily were not able to join the program because of administrative issues.

There is a similar explanation for the high school companies as well. On graph is shown that there is a three year period, where the number of companies is almost one and the same. For the 2008-2009 academic year there is a double increase that can be easily explained with series of national meetings with high school principals from all over Bulgaria. The following year 2009-2010 there is a slight decrease, which again, can be explicated with administrative issues.

- What is the distribution of student companies by percentage of male students? – Figure 5.



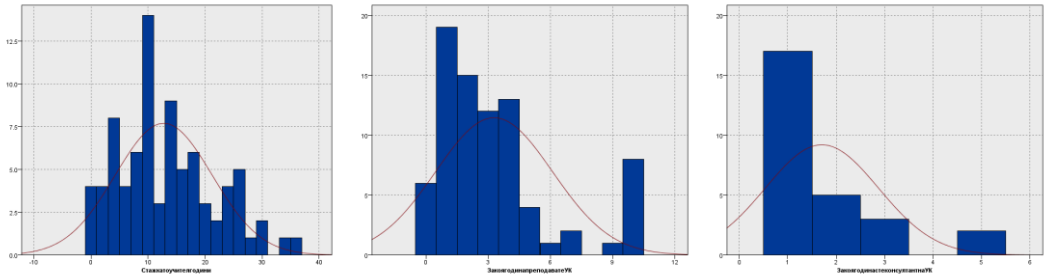
High school companies 2006-2010 (mean 40.9%)

University companies 2007-2010 (mean 54.3%)

Figure 5. Distribution of student companies by percentage of male students

Figures show that the distribution of high school companies by percentage of men is slightly right skewed, i.e. companies with lower percentage of men dominate. Distribution of university student companies by percentage of men is almost symmetric, i.e. student companies with relatively equal numbers of men and women dominate.

- How long teachers work for JA High School Company (2011 academic year)? – Figure 6.



How long you have been a teacher? (mean 12,7)

How long you have been a teacher in JA company program? (mean 3,3)

How long you have been a business consultant in JA company program? (mean 1,7)

Figure 6. Distribution of student companies by academic year

All three distributions are right skewed, i.e. they are dominated by companies with lower experienced teachers and business consultants.

- Which companies have real business (distribution by University)? Figure 7.

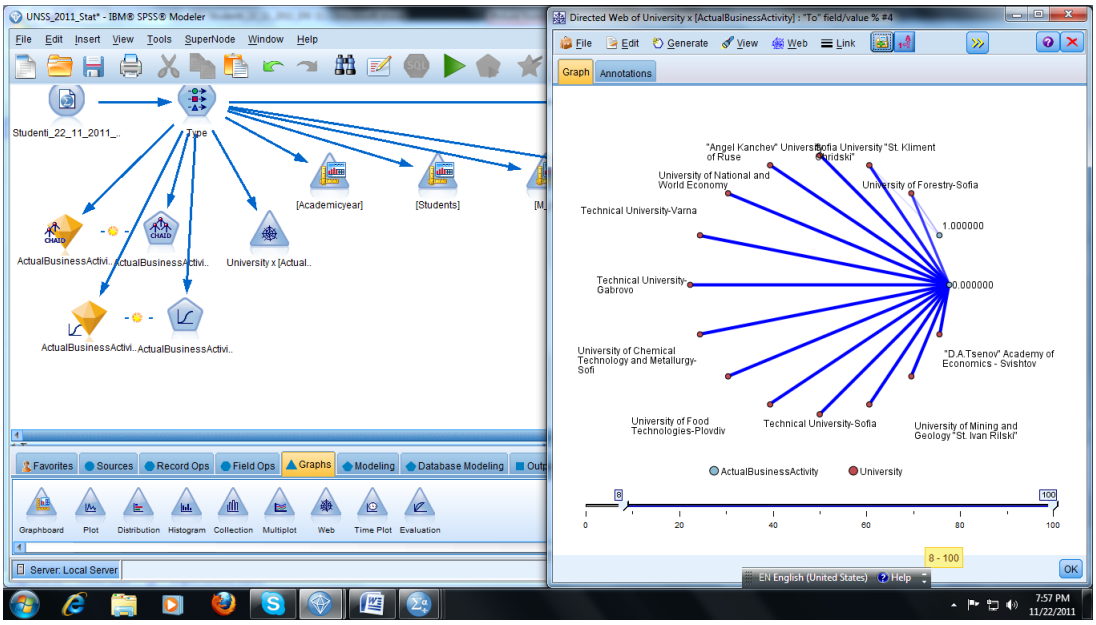


Figure 7. Companies with a real business by University

Only startup companies from Sofia University and the University of Forestry had real business during their participation in the JA Program.

- What are the predictors for establishing real business? Figure 8 – analyzed through Classification Trees and Figure 9 – analyzed through Logistic Regression.

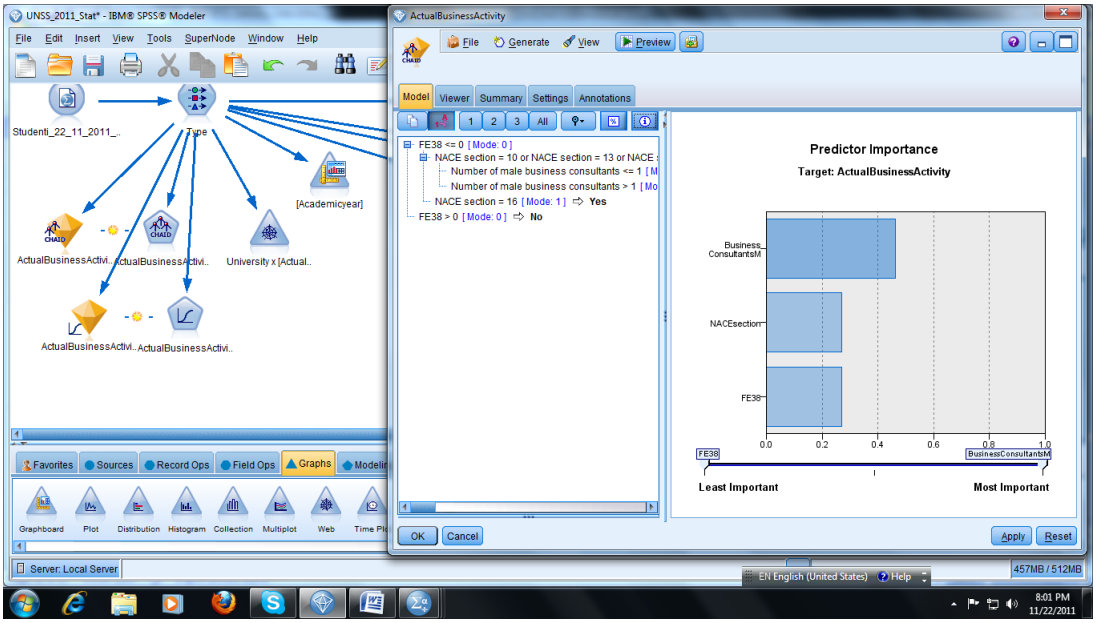


Figure 8. Predictors for establishing real business analyzed with Classification Trees

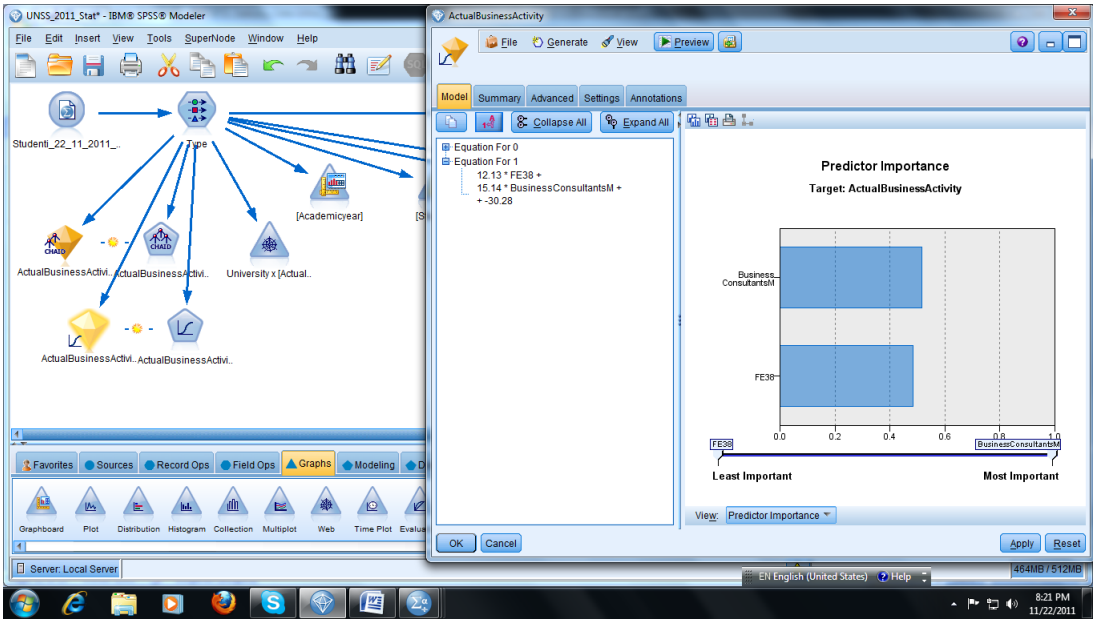


Figure 9. Predictors for establishing real business analyzed with Logistic Regression

The two figures above should be considered together because they show one and the same thing, but processed through two different methods. Both methods identified two important factors for establishing real business among students, involved in Company program: 1.) the number of men business consultant; 2.) law as a field of education. In addition to this, Classification trees reveal another important factor: section of National Classification of Economic Activities. The tree shows that if the student company has students from the "law" field of education then the chance for establishing own business increases. If there is more than one male consultant, the

chance for real business also increases. Logistic regression shows the same, but in another way.

4. CONCLUSION

Recognizing the best practices and creating roadmap to analytics is the first step in becoming a data-driven education organization. Understanding the relationships among all components is the next. Analytics can help teachers and professors to understand how their students are performing in practical situation, why, and how to get better. Consultants from the real business can make the most of the time they have with students, and organizations can adjust methods to build on success. Students can carry out their potential and make a significant and innovative contribution in their field of choice.

With this research, based upon historical data, we have established statistical model that can predict which student's competences or students company component are most important and valuable. IBM SPSS Modeler helps us to go inside, to be aware and to made connections that were not apparent to us outside, but proved to be extremely correct. The next step for our team is to put our new found predictive intelligence to work.

Acknowledgement

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